THE Chemical Age

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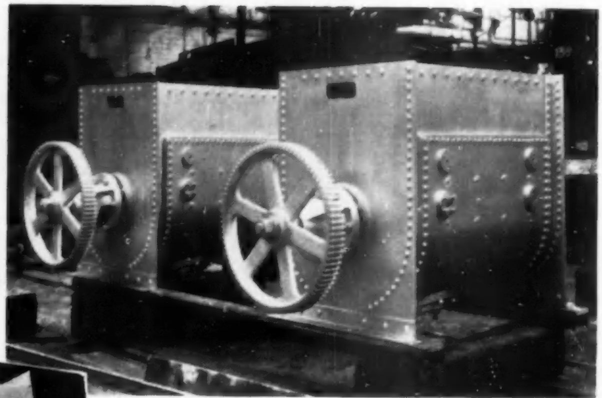

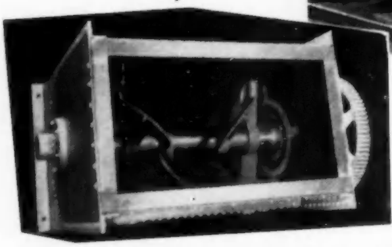

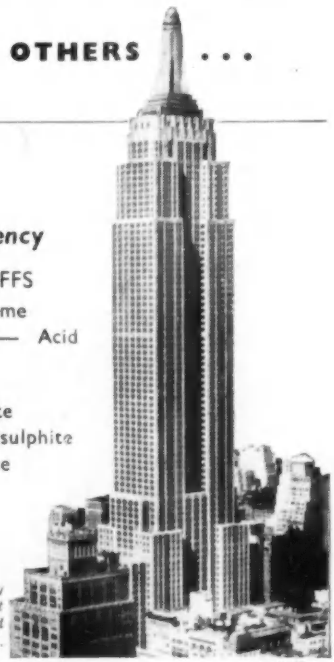

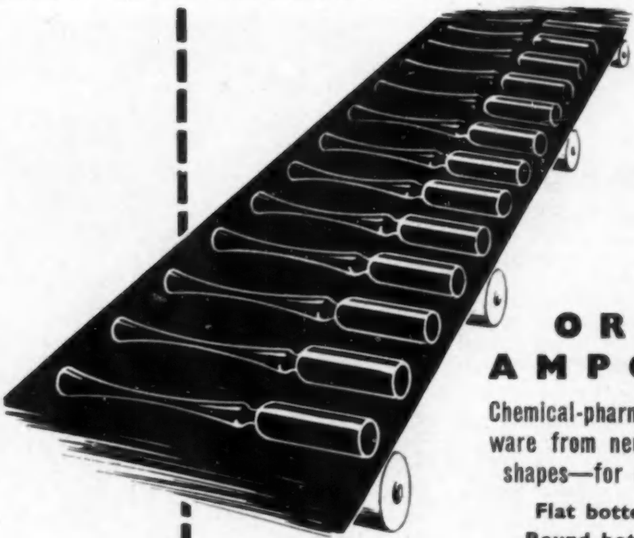

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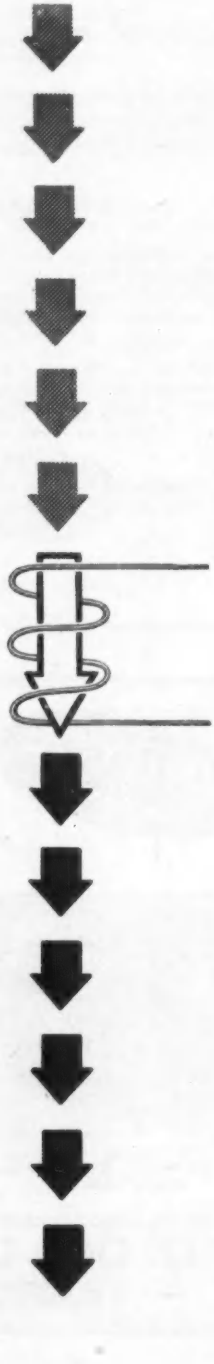

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Chemicals for the Soil

THE fertilizer industry is taking a breather after the spring peak of demand which, from all accounts, has been one of exceptional activity. But for a single factor this might suggest that fertilizer usage on our farms has again taken a sizeable stride forward, and a rather bolder stride than those of recent years.

However, it is known that in many areas autumn-sown crops suffered heavy losses this winter, and a substantial acreage has perhaps had to be re-sown and much of it re-fertilized as well. To whatever extent this influence has affected spring demand, it cannot be regarded as extra trade of a regularly repeatable kind. For the first time for several years actual shortages in supplies have been mentioned. Questions in the House of Commons in April referred to 'current difficulties of farmers in getting nitrogenous fertilizers', and later to 'the shortage of nitrogen, sulphate of ammonia, nitro-chalk, and other dressings in Lincolnshire'.

When the question was first raised, the Minister of Agriculture referred to the usual cause of local difficulties, the peak period of spring use. But under the pressure of further questions he drew attention to plans in hand for increasing manufacturing capacity for nitrogenous fertilizers.

Although figures are not yet available, it would seem fairly certain that there has been a record level of demand for nitrogen, and this has not been at all comfortably matched with supplies.

It is no less certain that any increase in consumption of nitrogen has largely made its way to our grassland acreage. The obvious need for an expanded use of nitrogen in this farming sector has been publicized for a number of years and, in general, the response has been disappointingly slow. No crop gives a more profitable return than grass for each hundredweight of nitrogenous fertilizer applied. Yet the national average rate per acre given to grassland is much below the rate for arable crops. Nitrogenous fertilizers are home-produced from coal and the abundant nitrogen of the air, and in terms of food for animals a sack of sulphate of ammonia or nitro-chalk is much more productive than a sack or more of imported feeding stuffs. Nor is this only a matter of national economy. It is also profitable economy for farmers, and made even more attractive by the subsidy paid on purchases of nitrogen.

Increased use of nitrogen is a feature of world fertilizer usage. This is shown by data in the last FAO review of fertilizer production and consumption. Consumption figures for the world excluding USSR and China were as follows:

	1,000s *of tons in terms of plant nutrients*		
	N	P_2O_5	K_2O
1953 ..	4,891	6,107	4,896
1954 ..	5,516	6,502	5,407
1955 ..	5,814	6,731	5,639
1956 (est.)	6,117	6,846	5,791

Thus, in four years the use of nitrogen has risen by 24 per cent, phosphates by 12 per cent, potash by 18 per cent. In Europe as a whole the increases over the same period are, respectively, 31, 20, and 18 per cent. This reveals a somewhat stronger tendency for nitrogen usage to advance more firmly than usage of the other two major fertilizer nutrients. So far this trend has not been shown nearly as emphatically in Britain, where over the past three years (again according to FAO data) nitrogen usage has risen by 6.1 per cent, phosphate 1.1 per cent, and potash 4.3 per cent. Yet few countries in the world have a greater grassland potential, or a more reliable climate for ensuring that high responses to fertilizers are obtained.

If, therefore, it is a sound deduction from the current reports of heavy demand that appreciably more nitrogen has been used (and perhaps that more would have been used but for temporary shortages), a significant and overdue change in farming policy may have taken place.

It is, of course, true that a considerable proportion of our grassland is managed on the self-supplying system of clover mixtures. The leguminous clovers are able to assimilate nitrogen from the air, and this bacterial winning of nitrogen offsets the fertilizer requirement. But if clovers in grassland are to make a good contribution they must be fed with the other fertilizer nutrients, particularly with phosphates.

If our grassland acreage was being made more productive by the clover method, steady increases in the use of phosphatic fertilizer would surely be revealed. Yet the annual rate of use of this nutrient has risen only by 1.1 per cent in the past three years. The clover system is a traditional system, known and practised since well before the advent of modern fertilizers. It seems a likely deduction, therefore, that clover-based grassland is being maintained at low and out-of-date production standards, largely ignoring today's possibilities of technical improvement.

Nor in any case is it true that applications of nitrogen are incompatible with clover development in mixed pastures. Nitrogen at moderate rates increases the production of protein and carbohydrate in the grasses without seriously inhibiting the contribution from clovers.

Another chemical required much more considerably for agriculture here is lime or limestone. By comparison with most other European countries, our annual lime usage seems impressive—it is four times the European average per acre, and exceeded only by Danish use. But owing to our higher rainfall the annual loss of lime—and therefore the annual increase in soil acidity—is particularly severe. Agricultural lime has long been subsidized. At present 60 per cent of the cost of lime, transport, and spreading is paid to farmers; and in the summer months, when attention to liming suffers a seasonal decline, this subsidy is raised to 70 per cent.

Liming can be looked upon as more of a public than private investment ! Yet too little is being used. Over the years the lime consumption statistics show that in most years the annual loss of lime is roughly balanced by applications, but, from the time lime subsidies began, almost 20 years ago, little or no attempt has been made to reduce the inherent or inherited acidity of our soils.

That is to say, the average acidity of British farmland is still about the same as it was 20 or 30 years ago, and all that the lime fertility scheme does is to keep the weakness from becoming more general. Last year the amount of lime or limestone applied to British soils fell sharply, largely as a result of bad weather. Will this be recovered during the current farming year ?

Although this reference may seem critical, producers and distributors should take heart. There is still room for expansion in trade. The last farm prices review—which increased the emphasis upon technical production grants and reduced that upon crop price support payments—has virtually served notice that agricultural prosperity and stability increasingly depend upon technical improvements in crop production.

Notes & Comments

Science & Service

THERE are strong rumours that a cut in the period of national service is being contemplated. So far, however, the only factual evidence is that the C3 conscript is uneconomic; the intake of this class is to stop. The soundness of the Government's move is unlikely to be disputed by any who judge human matters in terms of thought and logic, and not in terms of emotion and prejudice. Further limitations to the range of national service demands may be announced sooner or later, but at the time of writing the most beneficial limitation of all does not seem to be under consideration. This is, of course, the bringing to an end of the use of young, qualified scientists for two years of non-scientific national service. This is not national service at all, it is national disservice. At no time in history could an over-all policy exercise such an adverse effect upon the country's strength. This is not to suggest that the Services should not have scientists. On the contrary, they should have plenty of them, but not as temporary national servicemen. Plenty of evidence that young scientists are futilely utilized in national service exists, and for this the Services themselves are not to be blamed. Men who are only temporarily available cannot easily be fitted into technical posts. There is an understandable tendency to waste the young men's ability rather than make brief use of it.

National Defence

LAST month it was stated in Parliament that 7,500 graduate scientists and equivalent technologists were employed in civilian posts in our defence establishments, and that 3,000 men with such qualifications are doing national service. But the figures for officers and men in the Armed Forces with scientific qualifications of this standard was 'not readily available'. This could mean, of course, that the figure is known but is regarded as secret; or it could be true that the Government does not know the figure. Another 'unknown quantity' is the proportion of science graduates who take up civilian posts in defence. This is understandably obscure, for any estimate would depend upon returns from the universities. These returns are not only incomplete but do not distinguish between posts connected with defence or other industry. Nevertheless, the known facts show that for every 15 qualified scientists used for defence work, six young, qualified scientists are locked up in national service duties—and this at a time when no national asset is scarcer than scientific skill! The number of students (and not men only) taking first degrees and diplomas at universities in 1953/54 was 5,304. This figure provides a significant guide to the proportion of graduates who do national service, for the figure above of 3,000 is far from small when set against this other figure of 5,304 for male and female graduates.

Atoms for Peace

IN *Atoms for Peace Digest*, the US Information Service's weekly publication, one of the most stimulating chemical articles we have come across for some time has been fully reproduced (1956, **1** [25], 6). It is Dr. Walter Libby's reasoned plea for introducing a wide range of radioactive chemicals into student experience no later than their first college year. 'I should like to see on the reagent shelf in the standard chemistry laboratory . . . radioactive chemicals placed beside the conventional ones and distinguished from them by a small asterisk in the formula. . . . There would be the necessity merely of being sure that the radioactivities were so feeble as to be perfectly safe . . . the isotopes are now available.' Dr. Libby emphasizes the apparent 'law of nature' that longer living isotopes have softer radiations that will not penetrate the walls of ordinary Geiger counters or other measurement instruments. Radiation from radio-C with a 5,568-years half-life period can be stopped by a piece of paper. Radio-sodium 22, with a three-year half-life, has about three times radio-C's penetra-

tive capacity. Though this brings radiation measurement problems, it does mean that the longer-lived isotopes can be kept on the laboratory shelf for months or years without replenishment. The detection instrument problem is in any case tractable. A counting device with a wall made of metalized plastic sheeting, instead of metal is easily built; if students place precipitates in close contact with the wall of such a counter, maximum sensitivity is obtained.

Training Courses

THREE-MONTH training courses for selected school teachers are already in operation at Oak Ridge, and these 'radio-geared' teachers are subsequently travelling the country for nine months giving lecture-demonstrations in science classes at high schools. But the aim is not to make radiochemistry an adjunct to normal chemical education; it is to make it an integral part of higher school or college education. 'It will not be possible to maximize the good things the atom is bringing us without teaching radio-chemistry to all chemists. . . . The general improvement in the understanding of nuclear phenomena which would follow such an educational policy is of vital importance in the nation's welfare.' Dr. Libby is, of course, a well-known atomic scientist and a member of the US Atomic Energy Commission. It is easy to give a dusty answer to his plea and say there is 'nothing like leather'; most men are enthusiasts for their own specializations. But a glance at the chemistry of 15 or 20 years ago is quite enough to show how the pile-produced radio-isotopes have revolutionized the subject. Developments of the past five years show how rapidly the revolution is taking place. Today (perhaps we should say yesterday) every research centre aiming to use radioisotopes in its work tries to add to its staff one scientist skilled, or potentially skilled, in this field. Obviously this attitude cannot endure and most chemists, if not perhaps all, must in the future be familiar with radio-isotope methods. However, if Dr. Libby's views are given practical support in the United States, we shall have to be as enterprising here if we are not to drop behind US technology in 1966 or 1976. Indeed, in this field we might easily have taken both the initiative and the lead.

Fluorine Disposer

UNWANTED fluorine can be disposed of using an apparatus designed by AERE, Harwell, and described in 'An Apparatus for the Disposal of Fluorine on a Laboratory Scale' by G. Long.

Flow rates of up to 15 litres fluorine per hour can be dealt with in this apparatus. The fluorine is introduced into the centre of a semi-luminous coal gas flame at a concentric tube burner mounted in a combustion chamber. The products of combustion are drawn by suction through a perforated nickel plate immersed in 10 per cent caustic soda solution.

To minimize corrosion the whole of the disposer is constructed from nickel, although the combustion chamber and absorber could be of copper and glass respectively.

The disposer has been used for periods of up to six hours with flow rates of 15 litres per hour and the efficiency has been checked by observing moistened blue litmus papers in the extract line. These turned red only after several hours of running, showing that the concentration of fluorine and hydrogen fluoride in the emergent gas stream was very low.

This booklet can be obtained from AERE, Harwell, Berks, price 1s.

World Power Conference

The Fifth World Power Conference will open in Vienna on 17 June. At the AGM of the British National Committee, Would Power Conference, Sir Vincent de Ferranti (chairman and managing director, Ferranti Ltd.) was re-elected chairman of the British National Committee to serve for a further term of three years. Sir Vincent also holds the office of chairman, International Executive Council, World Power Conference. The 1955 annual report of the World Power Conference has just been published.

First Nuclear Reactor

Belgium's first nuclear reactor has begun operating at new laboratories near Antwerp. It will be used to study various civil applications of nuclear energy.

Slower Progress in German Chemicals

Ambitious Projects in Soviet Zone

IN spite of loss of output due to the severe cold, German chemical production continued to advance in the first quarter of this year. The leading producer puts the output gain compared with the corresponding period of 1955 at 11 per cent. Other manufacturers have also expressed their satisfaction with domestic and export sales in the past few months, but it is generally expected that the rate of expansion in production and sales will be somewhat smaller this year than last, largely because of lack of reserve capacity and, of late, shortage of manpower in some districts.

Firms which exhibited at the Hanover industrial fair early in May were satisfied with the interest shown by domestic and foreign visitors, especially in plastics and other synthetic materials. It was learnt that 130,000 tons of mineral oil products and 105 million cubic metres of natural gas—a total of 208,000 tons of liquid and gaseous products—were used for chemical purposes last year. It is intended to develop the production of petroleum chemicals in close conjunction with that of coal derivatives so as to meet the particular conditions prevailing in the Rhine-Ruhr area. Chemische Werke Hüls, Germany's largest producer of petroleum chemicals, is drawing on coke-oven products as well as natural gas from Bentheim and has arranged for the purchase of substantial tonnages of butane from oil refineries in the Ruhr area and as far away as Hamburg for feeding its syntheic rubber plant now under construction.

Benzol from Coking Industry

Phenol-Chemie GmbH, which produces phenol and acetone at Gladbach, is using benzol from the coking industry in conjunction with propylene from oil cracking for making cumol. Badische Anilin- und Soda-Fabrik, Ludwigshafen, is extending its colliery so as to meet all its coal requirements from its own mines, but the company is also drawing on natural gas for the production of ammonia and plastics raw materials. Farbwerke Höchst which is also using natural gas and operating its own oil cracker has developed its own process for splitting oil for the production of ethylene. Farbenfabriken Bayer is now working on a process for splitting oil for the production of olefines for its solvents and plastics manufacture.

The annual reports of leading chemical manufacturers indicate the growing attention paid to production possibilities abroad. Farbenfabriken Bayer has acquired a new interest in Brazil—where the company already owned two subsidiaries—Companhia de Acidos at Belford Roxo near Rio de Janeiro, whose manufacturing facilities are to be greatly extended. The first plant in Latin-America for making chromates is to be built here, and the manufacture of various agricultural chemicals is also to be undertaken.

Argentine Plant

In the Argentine, Bayer a few weeks ago started the manufacture of azo dyes through a partly-owned subsidiary, Fabrica Argentinia de Anilinas. Bayer intends to set up a company of its own in Mexico. In the United States the company holds a 50 per cent interest in Mobay Chemical Co. which started the production of polyesters and *iso*cyanates at the end of last year. Badische Anilin- und Soda-Fabrik has extended its foreign interests by acquiring an interest in a Brazilian firm and has set up a joint subsidiary with Farbenfabriken Bayer in Spain. Farbwerke Höchst also reports that establishment of production facilities abroad, i.e. in South America and Pakistan, forms part of its current expansion programme.

The first experimental nuclear reactors are expected to be put into operation in Germany in about two years' time, announced Dr. W. A. Menne, president of the Federation of the Chemical Industry, at a press conference. The first reactors for power generation would not be available for at least five years, but were expected to be operating in 10 years' time at the latest. Even then there could be no idea of closing the gap in power supplies by atomic energy. This gap would, at the earliest, be closed in 1970-1975. On the question of finance which has caused great concern in Germany, he said that the Government should finance the projects falling within its sphere—research reactors, university institutes etc.—

while industry would provide the capital for its own requirements in the nuclear field, if the Government allowed private firms to amortize atomic installations as they thought fit. A warning against hopes of early results from work in the atomic field is uttered both by Farbwerke Höchst and Farbenfabriken Bayer in their annual reports.

The Five Year Plan, for the period 1956 to 1960, which has been published in the Soviet zone of Germany, contains target figures in metric tons for a number of important products which, together with the percentage increases over 1955 announced at the same time, give an idea of the current level of chemical production in this region, which includes the important production centres of Merseburg, Bitterfeld, Schkopau, Piesteritz and Wolfen. The 1960 output targets include 725,000 tons of sulphuric acid (SO_3), an increase of 50 per cent on 1955; 350,000 tons of caustic soda (+37 per cent); 730,000 tons of soda ash (+59 per cent); and 335,000 tons of nitrogen fertilizers (in terms of N), an increase of 14 per cent. The output of potash salts is to be raised to 2,200,000 tons (K_2O) against 1,570,000 tons in 1955, of phosphates to 200,000 tons (P_2O_5), against 80,000 tons in 1955, and of synthetic fibres to 15,660 tons, compared with 3,500 tons last year. Espenhain and Boehlen are to be developed as centres of the organic chemicals industry, and gypsum is to be used as the raw material for making sulphuric acid in a second plant, the first one having evidently proved satisfactory. Among plastics, the production of polyvinyl chloride is to be increased to 72,000 tons by 1960.

Report on Flour

THE report of the panel on the composition and nutritive value of flour was published on 17 May.

The main conclusion of the panel is that the available evidence does not reveal any ascertainable difference between national flour as defined in the Flour Order 1953, and flours of extraction rate less than national flour, to which vitamin B_1, nicotinic acid and iron have been added in the amounts specified in the Flour Order 1953, which would significantly affect health in any foreseeable circumstances.

The Government has decided to accept this conclusion of the panel.

Diploma in Technology

New Award Equal to Honours Degree

THE National Council for Technological Awards is to grant a Diploma in Technology which will be denoted by 'Dip. Tech. (Eng.)' for engineering, and by 'Dip. Tech.' for other technologies. Announcing this last week, the National Council said that the courses for the diploma would be equivalent in standard to honours degree courses of a British university.

There will be two honours classes, first and second class. The intention is that a student who successfully completes the course will normally reach the level of second-class honours. Those who do not reach this standard may be considered for award of the diploma at the pass level.

Various Courses

The courses which will be recognized may be either full time or 'sandwich', of not less than three years' full time or four years if the course is 'sandwich'. Students attending full time courses will be expected to have suitable industrial training, amounting in aggregate to not less than a year in industry. This must be undertaken either before the course or during it or both.

A memorandum for distribution to schools, colleges, and education authorities, says that the minimum age of admission to courses will normally be 18. 'It should be assumed that the standard of admission to courses will be that of the general certificate of education with two appropriate subjects at advanced level and three subjects at ordinary level, or a comparable standard. Holders of good ordinary national certificates, for example, will be eligible; in most other cases national certificate holders will need additional instruction to qualify for entry to the course.'

Courses to be accredited are expected to include a thorough education in the fundamentals of science and technology and their application to development and design. The memorandum states that to help fit the students for future responsibilities, the courses must include 'liberal studies and some instruction in the principles of industrial organization'. Colleges seeking recognition for a course must make formal application to the National Council, which may decide to inspect any college.

Woodstock Agricultural Research Centre

Shell Consolidates & Expands Efforts

AS BRIEFLY mentioned in last week's issue, extensions to the Woodstock Agricultural Research Centre providing additional laboratory floor space of 8,500 sq. ft. were officially opened by Sir William Slater, executive secretary of the Agricultural Research Council on Tuesday, 15 May. The Centre is now the headquarters of all agricultural research carried out on this side of the Atlantic by the companies of the Royal Dutch Shell Group of companies.

Before 1954 this type of research was carried out both at Woodstock (in Kent) and Amsterdam in Holland and the extensions mentioned were planned to provide for the amalgamation. Many of the scientists manning the Centre (some 50-60) came over from Holland to make their homes in England.

The functions of the laboratory are to carry out basic research to discover new agricultural chemicals, to develop and test new products and to solve specific problems which arise from experience in the use of these new products.

The laboratories and other buildings connected with research cover approximately 25,000 sq. ft., and there are 4,600 sq. ft. of glasshouses equipped to provide temperatures and humidities met with in almost every country in the world. Research facilities include chemical synthesis, chemical analysis, chemical formulation, entomological, plant pathology and plant physiology laboratories. As well as the trials in the glasshouses, field trials are also carried out on the 254-acre farm at Woodstock and extensively throughout the UK, and in many overseas countries.

The farm's primary function is to provide for the testing under normal farming conditions of Shell agricultural chemicals but it is also intended that it should be run at a profit whenever possible. Cereal and root crops are alternated with seed leys on 170 acres and apples, cherries, hops, pears, plums and gooseberries are grown as regular perennial crops. Small plots of other farm products are grown from time to time.

Considerable basic research is carried out at Woodstock and the closest liaison is maintained with sister Shell laboratories in Colorado and California in the US, as well as with many universities and Government institutions. Much of this work is related to obtaining information on which the development of new toxic chemicals can be based and much of it is initiated in the chemical synthesis laboratory.

In this section, new chemicals are synthesized on the basis of various theories regarding the mode of action of biocides. Many of these compounds have never been made before and considerable research is often necessary for successful preparation. Once biological activity is shown by a

A general view of the administration block at Woodstock, showing the main entrance

An entomologist renews the water supply in the locust breeding cages

certain chemical it becomes necessary to prepare a series of related compounds to ascertain how changes in molecular structure affect this activity. For initial tests the amounts of a new compound needed may be only 5 gm., but for field tests up to 10 lb. of the test chemical must be synthesized and this often calls for additional research on methods of preparation.

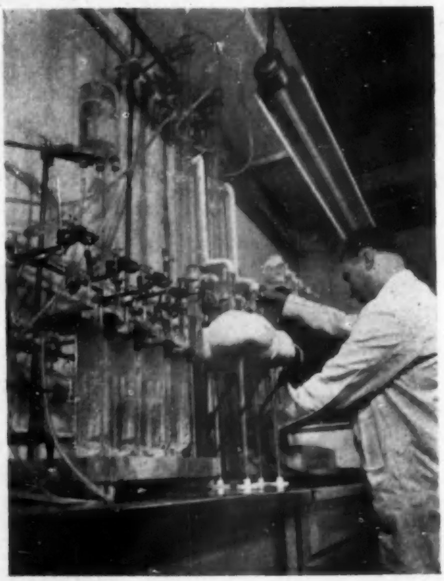
Analysis enters into every phase of work at Woodstock. The chemical analysis laboratory confirms the structure and purity of all newly-synthesized compounds, controls the composition and stability of experimental formulations and ascertains the amount of chemical residues which remain on treated plants and in animal organs. As many of the chemicals examined are new, investigations are undertaken into suitable methods by which they can be detected and estimated in quantity.

From the chemical synthesis laboratory compounds are passed on for screening tests to the other laboratories. Insecticides go to the entomological laboratories, weed killers or growth-promoting substances to the plant physiology laboratories and fungicides and viricides to the plant pathology laboratories.

In the entomological laboratory new chemicals are tested under controlled conditions for biological activity against insects and studies are made of the factors which influence their performance. Samples of crops treated experimentally, either on the farm or in other parts of the UK, are given detailed and microscopic examination. An important side of the laboratory's work is the use of susceptible strains of insects for bio-assay, which can be used to estimate residues too small to be determined by chemical analysis.

This department contains six constant-temperature rooms where experiments can be undertaken and insects bred in conditions of controlled temperature and humidity. In these rooms, and in the glasshouse, strains of flies, mosquitoes, fruit flies, locusts, aphides and red spider are permanently maintained for testing purposes and other species of insects bred as work demands. Many types of precision sprayers are used to ensure that a repeatable dosage of insecticide can be sprayed on the insects or plant and other surfaces.

The plant physiology laboratory makes initial tests on weed-killers and growth-promoters and a technique for observing the effect of chemicals on single plant cells



A member of the research staff prepares extracts from olive oil for micro-biassay, a biological technique for determining microquantities of insecticides

has been developed. A large stock of weed seeds is kept and these are germinated in the laboratory.

The spore germination technique, using plant leaves as a substrate, is used in the plant pathology laboratory for initially testing new chemicals. Compounds showing a high activity are transferred to the glasshouse for further trials. Cultures of plant fungi are permanently maintained in artificial media to provide a reservoir of fungal diseases ready for the innoculation of test plants at any time.

The glasshouses are really an extension of the biological laboratories. They provide facilities for testing chemicals against both pests and plant diseases in controlled conditions regarding temperature and humidity and where spraying by measured dosages can be carried out. The glasshouses are oil-heated with thermostatic controls and are equipped with ultra-violet lighting and apparatus for simulating the action of rain.

Further Research

Once a new compound has survived testing by these departments it is passed to the chemical formulation laboratory where research is undertaken into physico-chemical relationships which influence the field performance of products. This department is responsible for the formulation of all new chemicals for field testing and also develops the formulation manufacturing specifications and control tests which are used in full-scale manufacture.

Field trials on the farm extend over two or three years to allow for weather variations. If the availability of raw materials, the cost factor and the patent position permit, other laboratories in the Shell Group are called on to help produce sufficient quantities for full trials. These are on a country-wide, statistically-planned basis and many selected sites are used. Where appropriate, similar tests are carried out overseas so that the new product can be studied with different types of soil, rainfall, temperature, manurial treatment etc.

The final stage is reached when the product is handed over to the marketing organization for market development, although this often involves further tests in many parts of the world.

Woodstock was set up in 1954 by the Shell Petroleum Company but was taken over by Shell Research Ltd., on this company's formation in the same year.

Plant Protection

Second International Conference

THE second international conference on plant protection will be held at the Fernhurst Research Station of Plant Protection Ltd., near Haslemere, Surrey, on 19, 20 and 21 June, 1956. Some 96 delegates from 40 countries, including Russia, are expected to attend. An inaugural luncheon will be held at the Dorchester Hotel, London, on 18 June.

Mr. E. M. Fraser, C.B.E., chairman, Plant Protection Ltd., will open the conference on 19 June. The following papers will be presented: 'World Aspects of Crop Protection', by Dr. J. G. Knoll (FAO); 'Genetics in Relation to Crop Protection', by Dr. W. F. Hanna (Canada); 'The Mechanisms of Toxicity', by Dr. S. E. A. McCallon (US); 'The Role of Systemics in Crop Protection', by Dr. R. L. Metcalf (US); 'Residual Effects of Crop Protection Chemicals', by Dr. J. M. Barnes (UK); 'Applying Crop Protection Chemicals', by R. P. Fraser (UK). A demonstration of crop protection machinery will be held on 21 June. Over 20 British machinery manufacturers are co-operating in this demonstration. A visit has been arranged to the Jealott's Hill Research Station of ICI for 22 June.

Advance copies of the authors' papers will be circulated before the conference, in order to give the maximum time possible for discussion at each session. Opening speakers' papers will be available before the appropriate sessions. The chairman will sum up the discussion at the end of each session. The official conference language will be English.

Scholarship Chance

AN annual university scholarship in chemistry or chemical engineering is to be provided by Thomas Hedley & Co., to be competed for by its employees.

The objects in establishing these scholarships are, the company says, 'to help reduce the great shortage of technically trained graduates in this country, and at the same time to provide an incentive to men throughout the company who already have certain examination qualifications and who wish to equip themselves for a scientific career.'

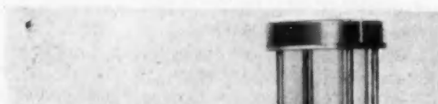
Each year the scholarship will be awarded for an Honours course at King's College, Newcastle upon Tyne.

Wave Pulse Generator

A NEW wave pulse generator, with great variability within the frequency range of 0 to 200 cycles per second, has been produced by D. F. Developments Ltd., 175 Piccadilly, London W1. Known as the 'Sonomec' energy generator, it is primarily intended for use in laboratories. It consists of a mechanically driven disc diaphragm which transmits vibrations to either liquids or solids placed in the 1 gallon capacity processing container. This may be supplied in transparent plastic or stainless steel.

The linkage mechanism, driven by the 2 HP electric motor, incorporates a means of adjusting the amplitude of vibration (0/3 mm) in an infinitely variable manner. Frequency can be varied without stopping the machine which weighs approximately 300 lb.

The standard 'Sonomec' unit is fitted with a container for processing liquids. In addition to this, other fitments may be attached so that electrical components, instruments etc., can be held firmly and vibrated. The vibrations may be arranged in either a vertical or horizontal plane—or, indeed, at any angle to suit specific requirements.



Sonomec Generator

New Petrochemical Plant

AS A first step towards meeting the steadily increasing demand for ethylene and propylene derivatives, Petrochemicals Ltd., a member of the Royal Dutch/Shell Group of companies, has started work on an extension to its Partington (Manchester) plant. These new facilities will include a plant for the production of some 25,000 tons per annum of ethylene oxide.

It is understood that the plant will employ the process worked out by Shell Development Co. in the US for the direct catalytic oxidation of ethylene. A new plant for the conversion of ethylene oxide to ethanolamines came into operation in January, and additional capacity for glycol ethers, polyglycols and nonionic surface active agents is in course of construction. On completion of the direct oxidation plant the existing ethylene oxide plant will be used to expand the present production of propylene oxide.

Transfer of the registered office of British Carbo Norit Union Ltd. is announced. As from 1 June the company's address will be London Road, West Thurrock, Grays, Essex (Telephone: Grays Thurrock 4845).

2nd Instrument Display

THE second display of instruments, organized by the Scientific Instrument Manufacturers' Association, opened on Tuesday 22 May for three months at the Instrument Centre, 20 Queen Anne Street, London W1.

This follows the successful experiment of the first display which attracted visitors from Canada, US, South America, India, Australia and the Continent.

The following firms are taking part:—C. Baker of Holborn; Burndept Ltd.; Elliott Bros. (London) Ltd.; EMI Electronics Ltd.; Ferranti Ltd.; Fleming Radio (Developments) Ltd.; Furzehill Laboratories Ltd.; A. Gallenkamp & Co. Ltd.; General Radiological Ltd.; Griffin & George Ltd.; Hendrey Relays Ltd.; Hilger & Watts Ltd.; Isotope Developments Ltd.; Labgear (Cambridge) Ltd.; Nash & Thompson Ltd.; W. Ottway & Co. Ltd.; W. R. Prior & Co. Ltd.; W. G. Pye & Co. Ltd.; W. F. Stanley & Co. Ltd.; Stanton Instruments Ltd.; H. Tinsley & Co. Ltd.; Unicam Instruments Ltd.; W. Watson & Sons Ltd.; Wray (Optical Works) Ltd.

ICI's Record Sales

Increased Activity at Home & Overseas

THE value and volume of ICI's sales in 1955 were both new records. Group consolidated sales amounted to £411,000,000 (including £42,800,000 in respect of the company's Canadian subsidiaries, for which only six months' sales were included in the consolidated sales figures for 1954) compared with £352,100,000 in 1954.

The high level of industrial activity at home increased the demand for the company's products and this coupled with the company's increased manufacturing capacity led to record sales in the home market. The value of exports from the UK was also higher than ever before, rising from £67,500,000 in 1954 to £71,100,000 in 1955.

Constructional Programme

Expenditure on the company's construction programme (including replacement of old plants and the purchase of Government assets) in 1955 amounted to £33,000,000 making a total expenditure up to the end of that year of £223,000,000 on new fixed assets since the end of the war.

The increase of £3,600,000 in the value of ICI's exports from the UK was mainly one of volume, since average export prices were relatively stable throughout the year. The principal markets where there were increases were the US, Union of South Africa, Australia, the Near East, West Africa and the Caribbean Zone.

ICI's total expenditure on research and development amounted to £9,440,000 in 1955. After allowing for increased costs, this represents an increase of about eight per cent in the actual volume of work compared with 1954. The annual report states, 'The wider the field of the company's activities, the wider too must be the enquiry into the basic chemistry and physics underlying the processes involved. It is only through possession of such knowledge that prompt action can be taken to match advances made by competitors or to modify existing products to meet new demands from customers. A recent example is provided by the prompt reply which the company has been able to make to the introduction of new types of high density polythene obtained by low pressure polymerization processes developed in Germany and the US. Before any of these were in commercial production in this country, the company was able to announce its ability to produce similar products by modification of the high pressure process originally invented in its Alkali Division laboratories.'

One of the company's main considerations regarding research and development is not the amount of money which can justifiably be spent on it, but the availability of suitable staff with scientific and technological education and training. The company's research staff, with their connections with universities, are collaborating closely with their personnel colleagues in searching for ways in which the company might help to increase the number and quality of science and technology graduates from the universities. One outcome of this has been the new ICI Transfer Scholarship scheme announced early in March 1956.

Research and development facilities in the company's subsidiary and associated companies in Canada, Australia and South Africa have also been extended.

Provision for depreciation by the group was £20,379,824 in 1955 compared with £16,617,557 in 1954. Of the increase in the provision, £1,002,663 related to plants of overseas companies and the remainder was due mainly to new home plants which came into production during 1954 and 1955.

Consolidated Income

Consolidated income before taxation amounted to £53,579,085 in 1955, compared with £47,684,602 in 1954. Taxation, both UK and overseas, based on the profits of the year and after taking credit for relief in respect of investment allowances on the new capital expenditure of the year, required provisions of £23,900,433 in 1955 compared with £21,226,230 in 1954. Consolidated income after taxation thus amounted to £29,678,652 in 1955 compared with £26,458,372 in 1954. After deducting the net dividends payable to minority members of subsidiaries and the undistributed income of subsidiaries, the net income of the company for 1955 was £23,977,163 compared with £21,741,904 in 1954.

Chemical & Dyestuffs Traders

Chairman Reviews Year's Activities

REPORTING to members of the British Chemical & Dyestuffs Traders' Association at the 33rd annual general meeting held in London on 17 May, the chairman, Mr. C. F. V. Blagden, announced that efforts to form a central organization for shippers had been successful and that the British Shippers' Council was now established with the strong support of the leading national organizations representing industry and commerce. One of the Council's first objectives, he said, would be to press for a revision of the conditions of bills of lading which permit shipowners to discharge cargoes to suit their own convenience, and declare a voyage terminated without reference to the shippers or consideration of the extra cost in which the shipper is likely to be involved.

'The broad basis on which organizations of this kind are set up', Mr. Blagden said, 'provides an effective means for dealing with the more general problems of the trader, and I would mention the work and influence of the British National Committee of the International Chamber of Commerce as an outstanding example....

'It is important to emphasise that these national movements are made possible only by the combined efforts of the trade associations, and therefore from the outset their success must depend upon the support which the individual firms give to their own trade association.'

Import Duty Rates

Mr. Blagden had said earlier that the existence of GATT had stabilized import duty rates for the time being but changes in the Key Industry Duty Exemption list were not infrequent, and it was sometimes necessary to put forward the views of interested members on the supply position of a Key Industry chemical when reimposition of the duty was contemplated by the Board of Trade.

During the year the Association had received an alphabetical list of chemicals to be included in the proposed common tariff nomenclature. Members had had an opportunity to peruse the list and had been invited to put forward their comments which had been the subject of representations to the Board of Trade.

During the past few years, he continued, they had seen the removal of many Government controls, and trade was moving more in the climate of free enterprise. Latterly, the President of the Board of Trade had announced that the release of certain Government surplus stocks would come under consideration, and they had been assured that the appropriate trade associations would be consulted in the arrangements for the disposal of these stocks.

Modern Research

There were few industries which could not derive some benefit from the new processes, and new materials, which modern research was making available, and it was through the merchant that these developments were brought, in the main, to the notice of potential consumers at home and overseas.

This creation of new markets was a natural activity for a nation which lived by trading, and the merchant had an indispensable place in the mechanism of international trade.

The overseas marketing of chemicals called for personal contact with the customer, and it was, of course, most important that a technical service should be provided. The established export merchants gave such a service.

The recent Economic Survey urged the need to step up exports, and the British merchant was ready to play his full part in meeting the competition which the United Kingdom must face in overseas markets.

As merchants they know that real prosperity could not come merely by production alone; it required production allied to a forceful and expanding sales policy with the profit margin of secondary importance.

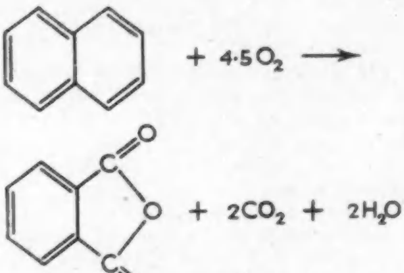
The annual luncheon of the Association was also held on 17 May at the Savoy Hotel in London when the toast 'The Association' was proposed by Lord Mancroft, Parliamentary Under Secretary of State, Home Office.

Petrochemical Phthalic Anhydride

Part II — Production

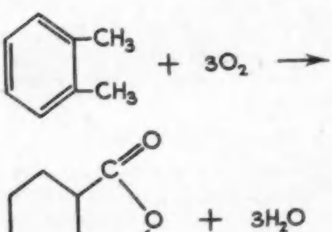
by P. W. SHERWOOD

COMMERCIAL phthalic anhydride production is today carried out universally by direct air oxidation of the hydrocarbon feedstock. Thus, naphthalene is converted according to the following reaction:—



Equation 1

o-Xylene oxidation takes a parallel path:—



Equation 2

Careful adjustment of reaction conditions is necessary. The ever-present danger of over-oxidation to maleic anhydride, or of complete combustion necessitates the choice of mild time-temperature conditions. On the other hand, operating conditions must not be so mild that the rate and extent of hydrocarbon conversion is economically insufficient. In such case, the formation of intermediate oxidation products (such as naphthoquinone from naphthalene and tolualdehyde from *o*-xylene) arises.

The use of a suitable catalyst, normally a form of vanadium pentoxide, is required to promote the desired oxidative attack on the stable structure of naphthalene (and also on *o*-xylene) at the permissible temperatures. In this reaction, the operating range is between 350 and 450°C. Spontaneous non-catalytic oxidation occurs at temperatures in excess of 500-600°C.

Reaction conditions subject to control are: preparation of catalyst, temperature, air:hydrocarbon ratio, and space velocity. The method of heat removal is of outstanding importance in the adequate control of the highly exothermic oxidation reaction. The reaction is carried out at substantially atmospheric pressure.

Catalyst Preparation

While different methods of catalyst preparation are used, they all embody vanadium pentoxide as active principle. A carrier is employed and incorporation of a small amount of potassium sulphate may serve to inhibit maleic anhydride formation.

The choice of silica gel or Alundum as catalyst carrier for V_2O_5 offers a number of advantages. Alundum has the special advantage of high heat conductivity—a feature of much importance in carrying out the highly exothermic reaction in fixed-bed converters.

One catalyst capable of attaining yields of 95 per cent was first made commercially available in 1949. The formulation is an impregnated silica gel containing vanadia and potassium sulphate. The carrier is prepared by the reaction of potassium silicate with sulphuric acid and is then dried. This support is then impregnated by precipitated vanadium pentoxide obtained from ammonium metavanadate.

This catalyst is reportedly used in a fluidized-bed phthalic anhydride plant. For

fixed-bed operation, the catalyst—at least in its original version—has drawbacks of low physical strength and of requiring longer contact times (10 seconds) for adequate conversion than are needed with conventional vanadia-Alundum catalysts. Typical size of catalysts granules for fixed-bed operation is 3/16 in. diameter.

The temperature-yield curve for a given set of operating variables in phthalic anhydride synthesis shows a pronounced maximum. At the lower temperatures, conversion of hydrocarbon is incomplete and the effluent stream will contain an increased amount of unconverted feedstock, as well as intermediate oxidation products. At higher-than-optimum temperature there will be excessive formation of higher oxidation products, notably maleic anhydride, carbon dioxide and water.

An Intermediate Product

Phthalic anhydride is believed to be merely an intermediate product of some stability in the complete combustion chain of the feed hydrocarbon. The optimum reaction temperature represents in this system the operating level at which the degradation reactions and the rate of naphthalene conversion are in best balance with the rate of phthalic anhydride formation.

Over commercially employed catalysts, reaction is not significant below 310°C. The impregnated gel catalyst, previously described, exhibits a yield maximum of 95.5 per cent at 370°C while another related catalyst attains its best performance at 345°C.

The proper operating temperature rises with the age of the catalyst, and the above data refer to fresh preparations. In any case, uniform temperature control cannot be obtained in the highly exothermic partial oxidation of naphthalene and *o*-xylene, except in fluidized-bed operation. In fixed-bed converters, a hot-spot is observed which travels gradually in the direction of stream flow. Operating conditions must be selected to prevent exceeding the catalyst fusion temperature at the hot-spot.

Practical air ratios must be much higher than theoretical (eq. 1 and 2) in order to achieve the desired degree of conversion and to maintain hydrocarbon concentration in the reactor stream below the explosive limit.

A plot of phthalic anhydride yield *v* air: hydrocarbon ratio will show a plateau of optimum performance. At lower air ratios, the formation of intermediate oxidation products is appreciable. If the amount of oxygen in the system exceeds the 'best' value, complete combustion becomes too great.

The optimum air: hydrocarbon ratio is an inverse function of temperature. In a series of *o*-xylene oxidation runs over supported vanadium pentoxide catalyst, the observed optimum ratio at 530°C was in the neighbourhood of 146 (=10.2 times theory). An air: xylene ratio in the range of 160 showed best performance at 500°C.

Phthalic anhydride is produced in single-pass conversion. Maximum yield per pass is therefore equivalent to maximum overall efficiency. By setting the amount of time allowed for the reaction, space velocity will determine both the yield of phthalic anhydride and the throughput per unit converter volume.

The optimum space velocity is directly related to the temperature. With rising temperature, the activity of the catalyst and the reaction rate are increased, and maximum raw materials utilization can be achieved at lower contact times.

At low space velocity, formation of higher oxidation products (maleic anhydride and beyond) is favoured. Conversely, a high space velocity leads to extensive formation of lower oxidation products and also results in insufficient conversion of the hydrocarbon. In one study, phthalic anhydride yield rose rapidly from negligible values at space velocity of 17,000 per hour to its optimum value at 33,000 and then dropped gradually. At space velocity 75,000, conversion had been reduced to approximately one-half of the maximum.

Special Design Problem

Heat evolution in the reaction represents a special design problem which is intensified as the degree of complete combustion increases. The partial oxidation of naphthalene to phthalic anhydride results in the evolution of 7190 BThU per lb. product (6200 BThU per lb. hydrocarbon). The complete combustion of naphthalene is 2.75 times as exothermic. Partial oxidation of *o*-xylene evolves only 3750 BThU per lb. phthalic anhydride (at theoretical conversion.)

Most existing phthalic anhydride plants operate fixed-bed reactors in which the catalyst is carried in tubes surrounded by a suitable heat exchange medium. For many years, boiling mercury served as preferred

heat exchange medium but this is now being largely abandoned in favour of nitrate-nitrite salts and, to a lesser extent, Aroclor heat exchange medium.

The need for close temperature control in so exothermic a system, makes phthalic a natural for application of the fluidized-bed technique. Today, three manufacturers (Sherwin-Williams, American Cyanamid, and Imperial Chemical Industries) employ fluidized-bed oxidation. There are, however, formidable engineering difficulties in the execution of this technique and these have deterred other producers from following suit. Hence, the fixed-bed phthalic anhydride process is still very much alive.

Operation of one commercial plant, using fixed-bed reactors for converting naphthalene to phthalic anhydride has been described by Sherwood (2). At this plant, an oxygen:naphthalene ratio of 33-35 (i.e., approximately eight times theory) is employed. Hot-pressed naphthalene and filtered air are pre-heated separately to 150 and 220°C, respectively. The hydrocarbon is evaporated into the air stream in a spiral-type vaporizer.

The reaction mixture enters the top of a number of tubular converters in parallel, and is cooled by circulating nitrate-nitrite salt mixture. Operation is on a single-pass basis. Catalyst temperature is controlled between 350 and 385°C. During the early stages of catalyst life, phthalic yield is at the rate of 2.1 pounds per cubic foot catalyst per hour. In the course of the years this figure is gradually reduced to an operating minimum of 1.85 pounds.

To Be Avoided

The catalyst is mounted inside the tubes. The presence of iron oxide in the system must be avoided since it tends to promote complete combustion.

On a long-term average, 86 per cent of the naphthalene fed to the reactors was converted to phthalic anhydride. Of the remainder, two per cent was converted to naphthoquinone, and an equal amount to maleic anhydride. A fresh catalyst yielded 100 pounds phthalic anhydride from an equal weight of napthalene. After ten years' use of the catalyst, converter yield had dropped to 95 pounds per 100 pounds naphthalene. Another three per cent was lost in the course of purification.

The products of oxidation, upon leaving the converter, are cooled to 200°C. At this temperature, the stream enters a series of rectangular condenser boxes ('hay boxes'). The first one of these is water-cooled, while the final units are air-cooled for the reduction of the temperature to 50°C.

Crude phthalic anhydride is removed from the bottom of the 'hay boxes' by means of screw conveyors. The crude product is charged to agitated mild steel pans, provided with heating coils. Here the material is melted and dehydrated.

Next in line is treatment of the crude with 98 per cent sulphuric acid at 200°C for the purpose of removing contained naphthoquinone. A fairly simple vacuum distillation serves to purify the product to meet sales specifications. The anhydride is taken overhead, cooled and solidified on drum flakers, and bagged ready for shipment.

Fluidized-Bed Oxidation

Fluidized-bed oxidation of naphthalene is today capable of providing a yield of 95 pounds phthalic per 100 pound feed hydrocarbon. In a plant of this type, preheated air is fed to the converter in which it comes into contact with the dense-phase catalyst-air system. Molten naphthalene is charged to the bottom of the reactor without prior vaporization.

Vapours leaving the dense-phase are freed of entrained catalyst in a disengagement space and an internal cyclone provided in the top of the converter unit. Effluent gases are cooled to a temperature just above the dew point of phthalic anhydride and are passed through a series of filters for recovery of contained catalyst dust. The clear gases are finally cooled in a series of phthalic condensers and are scrubbed prior to venting. Recovered product is refined by distillation and flaked in the usual manner.

The advantages of the fluidized-bed system include the ability to operate at lower air:hydrocarbon ratios than are possible in fixed-bed catalysts without fear of explosion. Furthermore, the fluidized-bed process can be operated at better thermal efficiency and a large amount of steam is generated in the cooling system provided for the conversion. Very uniform temperature is maintained throughout the catalyst zone.

(Concluded)

REFERENCES

(1) *Chemical & Engineering News*, 1956, 20 February, 856.

(2) Sherwood, P. W., *Pet. Ref.* 1953, 32 (4) 156.

DISTILLATION IN PRACTICE. Edited by Charles H. Neilsen. Reinhold Publishing Corporation, New York; Chapman & Hall Ltd., London. 1956. Pp. vi + 133. 24s.

This book comprises a collection of six papers on various aspects of distillation, originally presented at a meeting organized by the American Institute of Chemical Engineers for the benefit of its younger members in 1954. These papers, all by men of some experience, were intended to describe to the young graduate engineer some of the essentially practical techniques in the field of distillation.

The idea is not new—it has been practised for some years by the graduates and students section of our own Institution of Chemical Engineers with conspicuous success—but the publication *en bloc* of the papers presented at such a meeting differs from the practice in this country. That is not to say that the papers at these meetings are not worth publishing—indeed many of them are published separately by various technical journals—but those who attend these symposia absorb information as much from the interchange of ideas with their friends and colleagues in the special atmosphere which is found on these occasions, as from the content of the papers themselves, and their publication in book form is no substitute for the real thing.

The first two papers in this book, 'Overall Tower Design from a Process Viewpoint' by C. Pyle and 'Physical Design Features of Plate Columns' by R. L. Geddes, are without question, excellent in their own right and hardly to be bettered as lucid expositions of the techniques that the designer uses in combining the mass of conflicting desideratum, many of which are largely empirical, into a logical and workable design. The same cannot be said of the four remaining papers in this book.

The third paper is entitled 'Some Techniques in Petroleum Fractionation' and after reading it one wonders whether it was intended as a serious contribution or if the standard of training attained by those attending was very much lower than that which one imagines the average American graduate to have reached. The next paper, on 'Distillation Control', is somewhat better but is hardly as informative as half a dozen earlier papers on this subject which one remembers reading in the several American journals dealing with oil technology. These two papers may have been much improved in their verbal presentation, and this must certainly have been the case with the fifth paper called 'Operation of Distillation Equipment'. This is one of those collection of 'trouble shooting' lessons and tales of 'boners that we have pulled' illustrated by the usual schooldays idea of humorous drawings that are so beloved by our American friends but which make us shudder with embarrassment. No doubt it went down at the meeting in great style!

The final contribution deals with 'Some Commercial Aspects of Vacuum Distillation' and does little or nothing to relieve the mediocrity of the last two thirds of this little book. None of the last four papers has any references, there is no index nor oddly enough any table of contents. Altogether not by any means the sort of text that we have been by experience conditioned to expect from those who were so recently very much our elders and betters in the field of chemical engineering.—D.C.F.

DECHEMA-MONOGRAPHIEN Nos. 293-310. Vol. 25. Published for Dechema by Herbert Bretschneider and Kurt Fischbeck, Franfurt am Main, Western Germany. 1955. Pp. 200. Price: to members of Dechema DM 18.80, to non-members DM 23.50.

A series of topics discussed during a joint information-meeting of DECHEMA and VDI-Fachgruppe Verfahrenstechnik at Franfurt am Main in 1951 is presented in this volume. The papers, which are all in

German and have been revised and completed, are as follows:—

W. Meskat, 'Rheologie und Verfahrenstechnik', H. Trawinski, 'Zur Hydrodynamik aufgewirbelter Partikelschichten', W. Brötz, 'Der Stoff- und Wärmetransport in durchströmten Schüttgütern', C. Krijgsman, 'Versuchs- und Betriebsergebaisse mit Hydrozyklonen', W. Linke, 'Zum Wärmeübergang bei der Verdampfung von Flüssigkeitsfilmen', W. Hauschild, 'Verfahren der Dünnschichteneindampfung', P. Grassmann, 'Entwicklungslinen im Bau von Wärmeaustauschern', U. Happe, 'Entwicklungs-Tendenzen im Hochdruckbau', H. Vollbrecht, 'Dichtungen für Hochdruck-Schnellwerschlüsse', G. Diefenbach, 'Neue Anwendungsgebiete für stopfbüchsenlose Abdichtungen', K. Bungardt, 'Einfluss der Zusammensetzung nichtrotender stähle auf die Schwefelsäure- und Salzsäurebeständigkeit', R. Oetker, 'Einneuer elektropneumatischer Regier', H. Rumpff, 'Elektrische Druckmessung', K. E. Slevogt, 'Ein neues dielektrisches Präzisionsgerät mit grossem Frequenzbereich', Th. Gast, 'Die Braunsche Röhre als Anzeigegerät bei physikalisch-chemischen Messungen', H. Engelhardt, 'Temperatur- und Irreversibilitätsfehler von Glas- und anderen *p*H-Elektroden und ihre apparative Berichtigung', A. Naufmann, 'Ein neuer magnetischer Sauerstoffmesser mit nur geringer Abhängigkeit von Nebeneinflüssen', J. Fischer, 'Erfahrungen mit dem Flammenphotometer nach Richm-Lange.'

HYDROGEN IONS. By H. T. S. Britton. 4th edition. Vol. I. Chapman & Hall, London. 1955. Pp. xix + 476. Price 70s.

It is over 14 years since the 3rd edition of Professor Britton's book appeared. Because of the exigencies of war and the aftermath it has been out of print for most of this period. The arrival of the present volume is, therefore, all the more welcome in that it is so long overdue. As the subtitle indicates, it concerns itself with the determination of hydrogen ions. Their importance to pure and applied chemistry will be treated in volume II.

Until very recently, serious discrepancies existed in the electrometric methods of determining *p*H owing to the uncertainty of the potentials to be assigned to the various reference electrodes. With the object of removing these discrepancies and providing uniformity, the British Standards Institution set up in 1950 a committee 'for the standardization of the *p*H scale'. Professor Britton was a member of this committee which achieved the important task allotted to it. The present satisfactory status of the *p*H scale, and the considerations on which it is based, are, not surprisingly therefore, clearly set out in the volume.

Numerous buffer solutions based on the new BSI standard are described. These may be used in precise *p*H measurements involving the hydrogen, glass, quinhydrone or other suitable electrodes. Colorimetric and indicator methods of *p*H determination are also critically discussed. There are 155 tables of data and 93 diagrams in the book. It is well produced and has complete name and subject indexes, but the price seems just a little bit high.—H. MACKLE.

METHODEN DER ORGANISCHEN CHEMIE (Houben-Weyl). 4th Edition. Volume III. PHYSIKALISCHE FORSCHUNGSMETHODEN. Part 1. Georg Thieme Verlag, Stuttgart. 1955. Pp. xxx + 954. DM 162.

Volume III of the new 16 volume edition of Houben-Weyl deals with the application of physical methods to organic chemistry. In view of the importance and extent of this subject, the volume has been divided into two parts. Part 2 which deals with electrical, optical, magnetic and acoustic techniques has already been reviewed in these columns (THE CHEMICAL AGE, 1955, **73**, 1281). Part I is devoted to mechanical, thermal and microscopic methods, as well as mass spectrographic and isotopic techniques. The preparative aspects of isotope chemistry have already been discussed in Volume IV, part 2.

Most organic chemists regard thermodynamics as an unpalatable subject. This dislike, though sometimes justified, is most unfortunate as it is to a large extent responsible for the loose thinking which mars some published studies of reaction mechanisms. The opening chapter in this book is intended to help organic chemists to overcome their difficulties; it is an elementary account of thermodynamics based on lectures given at the University of Tübingen. Unfortunately, the subject is approached from the standpoint of a physical chemist, and organic chemists may therefore find this article just as indigestible as many of the standard textbooks. It seems a pity to devote 100 fairly expensive pages of

Houben-Weyl to this sort of exposition.

The second chapter, which deals with the determination of the kinetics of reactions (including chain reactions), provides a useful key to the literature. English readers may, however, prefer the more detailed account given in Weissberger's 'Technique of Organic Chemistry', a work which constitutes a formidable rival of those volumes of Houben-Weyl which are not concerned with preparative chemistry. The determination of density, solubility and vapour pressure is discussed in the following chapters. Two excellent sections provide accounts of methods for the determination of the molecular weights of both small and large molecules. Later chapters deal with surface tension, calorimetric methods, microscopy, crystallography, liquid crystals and the statistics of errors.

Welcome light relief is provided by a short but most informative chapter on atomic models by Professor Briegleb, who has himself designed a successful set of models. His critical account of the problems involved in the construction of adequate models will be welcomed by the many organic chemists who depend on models for the cure of their stereochemical headaches. It is illustrated with excellent photographs of molecules, set up in various types of commercially available models. The volume closes with a chapter on mass spectrometry and two sections on the use of radioactive and non-radioactive isotopes.—J.C.P.S.

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY. Vol. 2. Physics; Research Reactors. Compiled and published by the United Nation Scientific Secretariat, New York. 1956. Pp. 471. 57s.

The first half of this volume contains the records of the sessions 6A and 7A of the Geneva Conference which were devoted to 'Special Topics in Nuclear Physics' and 'Fission Physics' respectively. Reports of experimental work are interspersed with theoretical papers.

The other half of this volume is devoted to the description of, and experience gained with, research reactors, i.e. reactors as a source of radiation for experimental and isotope production purposes. This will have a wide appeal. The section opens with a survey 'Report on Research Reactors' (paper P/946) which indicates their very wide scope as research tools and then reviews technological factors affecting the choice of a research reactor. Two further introductory papers supplement and, inevitably, overlap with the first.

While operating experience is interpolated into the reports of proved examples, no paper contributes a general review of operational behaviour as its principal topic. The need for planned insertions of irradiation specimens and for adequate excess reactivity to cope with them and for the growth of neutron absorbing 'poisons' formed in the fission chains is referred to often. In particular, the production of the very neutron absorbent ^{135}Xe as an equilibrium decay product has such an effect that, after a reactor has been shut down for a short time, the relative xenon concentration will be so large that there will be insufficient available neutrons to begin a self sustaining chain reaction until this ^{135}Xe has, in turn, decayed. The need to release energy stored by a graphite moderator under irradiation in lower temperature pile working conditions—the Wigner effect—is very important since, if the fuel elements are designed for comparatively low temperature operation, they may be damaged by the pile temperature increase consequent upon an uncontrolled energy release in the course of routine operation. A brief review of the Wigner effect is given in paper P/860 but this operational precaution, the need to bring a reactor back into operation before 'Xenon poisoning' develops, and other such points could have provided subject matter for a brief informative paper on reactor operation. Accidents are mentioned, but always the available facilities have been adequate to prevent disaster.

It is interesting to read (P/387) that French experience using compressed gas is the heat transfer agent in a research reactor convinced them, incidentally, of the feasibility of a power reactor of the 'PIPPA' principle. In this volume, though, the emphasis is on the research facilities offered by the reactors. It is Volume 3 which details experience with, and hopes for, power production reactors.

One short paper, under the misleading title of 'The Need for Basic Research in an Atomic Energy Project' (P/804) really describes the immensity of the American research effort and the success of their trust in private industry and the universities who co-operate to carry it out.—J.S.M.B.

HOME

Exemptions from KID

The Treasury has made an order under Section 10(5) of the Finance Act 1926 exempting the following chemicals from Key Industry Duty for the period beginning 19 May, 1956 and ending 18 August, 1956. Synthetic organic chemicals, analytical reagents, other fine chemicals and chemicals manufactured by fermentation processes, the following: Monochloroacetic acid, sodium monochloroacetate (a monochloroacetic salt). This order is the Safeguarding of Industries (Exemption) (No. 5) Order, 1956, and is published as Statutory Instruments 1956, No. 717. Copies may be obtained (price 2d., by post 3½d.) from HMSO, Kingsway, London WC2, or through any bookseller.

Organotin Chemistry

Organotin chemistry was the subject reviewed at the Tin Research Institute's recent 5th annual 'Journée d'Etain' in Paris. A report of the symposium appears in the quarterly journal, *Tin and Its Uses*, published by the Tin Research Institute at Fraser Road, Greenford, Middlesex.

BP's Oil Refinery Expansion

Construction has begun at BP's oil refinery on the Isle of Grain, on the major expansion scheme which will enable the refinery to process some 7,000,000 tons of crude oil a year. At present its capacity is some 4,500,000 tons a year. The cost of the expansion, which includes a 130,000 tons a year aviation gasoline plant, is estimated at £26,000,000. Major processing plant to be built includes: one distillation unit; one catalytic reformer; one thermal reformer; two hydrofiners; one stabilizer; two solutizers; two copper chloride units; one alkylation unit.

RIC Tennis Tournament

A tennis tournament will be held by the London Section of the Royal Institute of Chemistry at the sports ground, University of London King's College, Lavender Avenue, Mitcham, Surrey, on Saturday 14 July. An informal dance will be held in the evening. Those wishing to take part should apply to Mr. P. F. Corbett, Shell-Mex & BP Ltd., SE London Branch, 16 High Street, Bromley, Kent.

British Celanese on Deeside

The five-year-old plans of British Celanese to open a £6,500,000 plant at Drum on lower Deeside may yet be successful. It is learned that the firm are still interested in setting up a factory on Deeside. 'We are still investigating a possible site', said a spokesman of British Celanese. 'There are a number of legislative points still to be cleared up and these will take time.'

£3,000,000 to be Spent

The North British Rubber Co. are to spend about £3,000,000 in the next three years on modernization and expansion at their Castle Mills factories in Edinburgh and at Heathhall, Dumfries. Roughly one third of the area of Castle Mills will be cleared to make way for a new one-storey building of 145,000 square feet for the manufacture of selected general rubber products. A statement by Sir William Wallace, chairman of the company, says that in addition to rubber products 'the broad field of synthetics and plastics offers further promise.'

Pay Increase

Imperial Chemical Industries Ltd. is to pay an extra 3½d. an hour to engineering craftsmen. The award was made by a board of arbitration which sat recently, and the company has agreed with the engineering unions that it should be back dated to 23 January. Smaller increases for lesser skilled engineering workers have also been agreed.

Industrial Accident Prevention

A report of the Industrial Safety Sub-Committee of the National Joint Advisory Council, 'Industrial Accident Prevention' has been published by HMSO, price 1s. 6d. A 35-page booklet, it deals with the problem of accidents and their prevention; the organization of safety in works; research; the factory inspectorate; and a summary of conclusions and recommendations.

Prize Flight

One of the prizes offered at the recent dance organized by Menley & James, fine chemicals manufacturers of Brixton, London, was a trip in a helicopter which took part in the Grahamland survey. The winners were Mr. and Mrs. P. A. Barnes, of Streatham. Mr. Barnes is the company's export department manager.

· OVERSEAS ·

Trimethylolpropane

The chemical division of Celanese Corp. of America announces that it is producing pure-grade flake trimethylolpropane commercially at 43 cents per pound in carload quantities. In alkyd-base baking enamels, trimethylolpropane contributes to better adhesion, colour, colour retention and hardness. It also affords greater mixing ease in compounding polyesters and pre-polymers with di-isocyanates.

Football Pool Profits Again Aid Research

Norwegian scientific research will again benefit from football pool profits which last year totalled $4,000,000. Since the scheme was established through an Act of Parliament eight years ago the entire profits of the football pools have been distributed to science and sport.

Solar Still Purifier

The first commercial solar still has begun operations at Mildura, Victoria, Australia, for removing minerals from water. The water to be treated by the device is first siphoned into a trough and then evaporated by the sun shining on to a glass canopy above it. When sufficient vapour has collected, the water condenses and runs into channels from where it is piped away to tanks.

Technion Designed

Among the equipment displayed at the recent atomic energy exhibition at the Technion (Israel Institute of Technology) in Haifa, was apparatus for nuclear research designed and constructed at the Technion.

German Potash Sales Up

West German potash sales in the year ended 30 April, 1956, amounted to 1,615,000 tons, against 1,512,000 tons in the preceding year. Britain was the largest importer, buying 113,300 tons. Shipments to Japan amounted to 110,000 tons.

First Uranium Factory

The Argentine National Atomic Energy Commission has announced that the first factory in South America to produce metallic uranium will be established at Ezeiza, near Buenos Aires. Orders have been placed for a pilot atomic reactor and a 10,000 kW reactor. These reactors and the mill will use locally-produced uranium and thorium.

Refinery in Operation

Daura refinery, 15 kilometres from Bagdad, is now in operation, it is announced. Crude oil is carried by a 12 inch pipeline from oilfields at Kirkuk, 300 kilometres distant. Capacity for the new refinery is 8,760,000 barrels a year of gasoline, fuel and other oils for local consumption, valued at ID12 million. This state-owned refinery was built in less than two years by British and American contractors and is believed to be the largest state-owned enterprise in the Middle East.

Kelvin & Hughes at Poznan

Kelvin & Hughes Ltd. will occupy a stand at the XXV Poznan International Fair, to be held from 17 June to 1 July. Three divisions of the company, and Simplex-Ampro Ltd., will be represented. All the instruments and display material will be packed into a company's van which will be shipped to Gdynia.

NY Plastics Exposition

A special delegation of 59 plastics industry representatives from various countries will attend the seventh National Plastics Exposition and Conference organized by the Society of the Plastics Industry Inc. and scheduled to be held in New York from 11 to 15 June. The Exposition will be held at the new Coliseum each afternoon and will be the industry's largest to date. More than 230 companies will take part, occupying upwards of 300 stands.

Capacity to be Trebled

Capacity of the Shell refinery at Hamburg is to be almost trebled by the end of 1958, going from 0.9 million tons to 2.5 million tons. The cost of the catalytic cracking plant already under construction is £21 million, Deutsche Shell announces. The installation will include a platforming high-octane plant designed for an annual output of 100,000 tons of petroleum.

Plant Officially Opened

What is described as the biggest sulphuric acid plant in the British Commonwealth has been officially opened at Birkenhead, Australia. The plant actually went into production last August, since when it has made 58,000 tons of acid, said Mr. H. W. Lyons, chairman of Sulphuric Acid, owners of the plant.

PERSONAL

MR. JULIAN M. LEONARD has been reappointed president of the Society of Chemical Industry for 1956-57. DR. H. LEVINSTEIN and SIR ERIC RIDEAL have been appointed past presidents, members of Council, and MR. G. O. CURME and PROFESSOR H. D. KAY have been appointed vice-presidents for the term 1956-59.

The following changes on the boards of the Geigy group of companies have been announced. From 1 July MR. GEOFFREY PARKES, chairman of Geigy (Holdings) Ltd., will resign, but will retain his seat on the board. He will be succeeded by MR. C. F. GYSIN; the deputy chairman will be MR. H. L. ADDLESHAW. Mr. Gysin has retired from the boards of Geigy Co. Ltd., and the Geigy Pharmaceutical Co. Ltd., and is also to retire from the boards of Geigy (Australasia) Pty. Ltd., and Geigy South Africa (Pty.) Ltd. The Geigy Co. Ltd.: MR. E. G. TURNER succeeds Mr. Gysin as director and chairman and MR. H. CLAYTON, the managing director, has been appointed deputy chairman as well. MR. G. A. CAMPBELL and MR. H. JONES have been appointed joint-assistant managing directors. The Geigy Pharmaceutical Co. Ltd.: DR. H. B. KNUCHEL appointed a director, and MR. H. L. ADDLESHAW appointed to succeed Mr. Gysin as chairman. Ashburton Chemical Works Ltd.: MR. H. JONES appointed to succeed MR. H. CLAYTON on the board. James Anderson & Co. (Colours) Ltd.: DR. E. KELLER and DR. E. M. STEAD have been appointed directors. Geigy South Africa (Pty.) Ltd.: MR. H. CLAYTON appointed to succeed Mr. Gysin as director and chairman.

MR. J. R. RYLANDS, M.Sc., M.I.Mech.E., M.I.E.E., F.Inst.F., is to succeed MR. R. H. GUMMER, M.I.Mar.E., F.Inst.F., as president of the Institute of Fuel in October.

The following officers and executive committee have been elected by the Association of British Insecticide Manufacturers:—*chairman*: MR. M. N. GLADSTONE, Fisons Pest Control Ltd.; *vice-chairman*: MR. GEORGE HUCKLE, Shell Chemical Co., Ltd., *hon. treasurer*: MR. H. J. JONES, O.B.E., Hemingway & Co. Ltd.; *hon. auditor*: MR. N. B. TAYLOR, Hickson & Welch Ltd.; *executive committee*: MR. R. E. BERK, F. W. Berk & Co. Ltd.; MR. R. V. CRAVEN, W. J. Craven & Co. Ltd.; MR. A. T. DAVEY, Burt Boulton & Haywood Ltd.; MR. D. J. S. HARTT, May & Baker Ltd.; MR. A. G. HOY, British Nicotine Co. Ltd.; MR. H. C. MELLOR, Bayer Agriculture Ltd.; MR. A. J. MOYES, Mirvale Chemical Co. Ltd.; MR. R. C. STOTTER, Plant Protection Ltd.; MR. N. K. SMITH, The Murphy Chemical Co. Ltd.; *ex-officio*: MR. F. W. SUGDEN, Plant Protection Ltd.; *hon. vice-chairman*: MR. H. J. JONES, O.B.E., Hemingway & Co. Ltd.; *secretary*: MR. W. A. WILLIAMS, M.B.E., B.Sc.

MR. S. F. MENDAY has been appointed a director of Athole G. Allen (London) Ltd., chemical manufacturers and merchants.

Appointed to the newly created post of technical adviser to the directors of Lorilleux & Bolton Ltd., printing ink and varnish manufacturers, of Ashley Road, London N17, is DR. R. F. BOWLES, F.R.I.C., a former honorary editor of the official journal of the Oil and Colour Chemists' Association. Dr. Bowles is well known as a research chemist in the printing ink and printing industries.

MR. JOHN SPENCER RIVAZ, A.R.Ae.S., has been appointed technical sales manager to Smiths Aircraft Instruments Ltd. as from 1 June in succession to MR. A. I. O. DAVIES who is leaving the company to emigrate to Canada. Mr. Rivaz is at present technical services manager to Kelvin & Hughes (Aviation) Ltd. one of the Smiths Group of aviation companies. Mr. Rivaz, who joined the company in 1937 after leaving Westminster School, flew RAF Mosquitos on low level intruder operations during the war. MR. DOUGLAS GEORGE JOHNSON, has been appointed contracts manager to SAI.

SIR HUGH BEAVER is to resign from the chairmanship of the Advisory Council of the DSIR, but will continue to serve as a member of the council. SIR HARRY JEPHCOTT, chairman and managing director of Glaxo Laboratories Ltd., has accepted an invitation to become chairman.

British Chemical Prices

(These prices are checked with the manufacturers, but it must be pointed out that in many cases there are variations according to quantity, quality, place of delivery, etc.)

LONDON.—Trading in chemicals during the week followed much the same pattern as for the past month although conditions generally have been somewhat quieter due to seasonal influences. Contract deliveries to the home industries have been maintained. Active items include tartaric and citric acids and chlorate of soda while there is buying pressure for titanium pigment, and the movement of fertilizers continues to be good. Prices in most sections of the market are steady with a firm undertone. There has been no alteration in the coal-tar products either as regards prices or conditions.

MANCHESTER.—The Manchester market in heavy chemical products during the past week has been noticeably under the influence of the Whitsuntide holiday stoppages at the consuming end, and quite trading conditions generally have been reported. Deliveries against contracts have been on a smaller scale, as have also fresh bookings. Traders, however, are confident of a prompt resumption of normal market activity in the coming week. Business in fertilizers, as well as the coal-tar products, has also been affected, though in the case of the former the usual end-of-season influences are also at work.

GLASGOW.—From most sections of the Scottish heavy chemical market a good volume of business has to be reported, the bulk being for prompt delivery, with some forward bookings. Although some prices are showing an upward tendency, generally the position is steady to firm. On the agricultural side business has been brisk with steady seasonable demands.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 10 tons, £83 ; 80% pure, 10 tons, £89 ; commercial glacial, 10 tons, £91 ; delivered buyers' premises in returnable barrels (technical acid barrels free) ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £123 per ton.

Alum.—Ground, about £25 per ton, f.o.r. MANCHESTER : Ground, £25.

Aluminium Sulphate.—Ex works, £14 15s per ton d/d. MANCHESTER : £15 to £17 15s.

Ammonia, Anhydrous.—1s 9d to 2s 3d per lb.

Ammonium Bicarbonate.—2-cwt. non-returnable drums, 1-cwt. non-returnable kegs ; 1-ton lots, £50 5s per ton.

Ammonium Chloride.—Per ton lot, in non-returnable packaging, £27 17s 6d.

Ammonium Nitrate.—D/d, £31 per ton (in 4-ton lots).

Ammonium Persulphate. — MANCHESTER : £6 2s 6d per cwt., in 1-cwt. lots, delivered. £112 10s per ton, in minimum 1-ton lots, delivered.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £101 and £97 10s per ton.

Antimony Sulphide.—Crimson, 4s 4d to 4s 9½d ; golden, 2s 7½d to 4s 0¾d ; all per lb., delivered UK in minimum 1-ton lots.

Arsenic.—Per ton, £45 to £50 ex store.

Barium Carbonate.—Precip., d/d ; 4-ton lots, £41 per ton ; 2-ton lots, £41 10s per ton, bag packing.

Barium Chloride.—£42 15s per ton in 2-ton lots.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £42 10s per ton d/d ; 2-ton lots, £43 per ton d/d.

Bleaching Powder.—£28 12 6d per ton in returnable casks, carriage paid station, in 4-ton lots.

Borax.—Per ton for ton lots, in hessian sacks, carriage paid : Technical, anhydrous, £61 10s ; granular, £41 ; crystal, £43 10s ; powder, £44 10s ; extra fine powder, £45 10s ; BP, granular, £50 ; crystal, £52 10s ; powder, £53 10s ; extra fine powder, £54 10s.

Boric Acid.—Per ton for ton lots, in hessian sacks, carriage paid : Technical, granular, £70 ; crystal, £78 ; powder, £75 10s ; extra fine powder, £77 10s ; BP granular, £83 ; crystal, £90 ; powder, £87 10s ; extra fine powder, £89 10s.

Calcium Chloride.—Per ton lots, in non-returnable packaging : solid, £15 ; flake, £16.

Chlorine, Liquid.— £37 10s per ton, in returnable 16-17-cwt. drums, delivered address in 3-drum lots.

Chromic Acid.—2s 0⅝d per lb., less 2½%, d/d UK, in 1-ton lots.

Chromium Sulphate, Basic.—Crystals, 7⅞d per lb. delivered (£73 10s per ton).

Citric Acid.—1-cwt. lots, £10 5s cwt.

Cobalt Oxide.—Black, delivered, bulk quantities, 13s 2d per lb.

Copper Carbonate.—3s 3d per lb.

Copper Sulphate.—£107 15s per ton f.o.b., less 2% in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £11 12s.

Formaldehyde.—£37 5s per ton in casks, d/d.

Formic Acid.—85%, £86 10s in 4-ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1.260 S.G., £12 9s 0d per cwt. Refined pale straw industrial, 5s per cwt. less than chemically pure.

Hydrochloric Acid.—Spot, about 12s per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s 6d per lb.

Hydrogen Peroxide.—27.5% wt., £128 10s per ton. 35% wt., £158 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed B.P., 17s 7d per lb., in 28-lb. lots.

Iodoform.—£1 6s 7d per lb., in 28-lb. lots.

Lactic Acid.—Pale tech., 44 per cent by weight, 14d per lb. ; dark tech., 44 per cent by weight, 9d per lb., ex-works ; chemical quality, 44 per cent by weight, 12¼d per lb., ex-works ; 1-ton lots, usual container terms.

Lead Acetate.—White : About £150 per ton.

Lead Nitrate.—About £135 1-ton lots.

Lead, Red.—Basis prices per ton. Genuine dry red, £140 10s ; orange lead, £152 10s. Ground in oil : red, £160 ; orange, £172.

Lead, White.—Basis prices : Dry English in 5-cwt. casks £145 15s per ton. Ground in oil : English, 1-cwt. lots 194s per cwt.

Lime Acetate.—Brown, ton lots, d/d, £40 per ton ; grey, 80-82%, ton lots, d/d, £45 per ton.

Litharge.—£142 10s per ton, in 5-ton lots.

Magnesite.—Calcined, in bags, ex-works, about £21 per ton.

Magnesium Carbonate.—Light, commercial, d/d, 2-ton lots, £84 10s per ton, under 2 tons, £92 per ton.

Magnesium Chloride.—Solid (ex-wharf), £16 per ton.

Magnesium Oxide.—Light, commercial, d/d, under 1-ton lots, £245 per ton.

Magnesium Sulphate.—Crystals, £16 per ton.

Mercuric Chloride.—Technical Powder, £1 3s 6d per lb., in 5-cwt. lots ; smaller quantities dearer.

Mercury Sulphide, Red.—£1 9s 3d per lb., for 5-cwt. lots.

Nickel Sulphate.—D/d, buyers UK £170 per ton. Nominal.

Nitric Acid.—80° Tw., £35 per ton.

Oxalic Acid.—Home manufacture, minimum 4-ton lots, in 5-cwt. casks, about £130 per ton, carriage paid.

Phosphoric Acid.—Technical (S.G. 1.700) ton lots, carriage paid, £92 per ton ; B.P. (S.G. 1.750), ton lots, carriage paid, 1s 3½d per lb.

Potash, Caustic.—Solid, £93 10s per ton for 1-ton lots ; Liquid, £36 5s.

Potassium Carbonate. — Calcined, 96/98%, about £74 10s per ton for 1-ton lots, ex-store.

Potassium Chloride.—Industrial, 96%. 1-ton lots, about £24 per ton.

Potassium Dichromate.—Crystals and granular, 1s 1d per lb., in 5-cwt. to 1-ton lots, d/d UK.

Potassium Iodide.—B.P., 14s 1d per lb. in 28-lb. lots ; 13s 7d in cwt. lots.

Potassium Nitrate.—In 4-ton lots, in non-returnable packaging, paid address, £63 10s per ton.

Potassium Permanganate.—BP, 1-cwt. lots, 1s 9d per lb. ; 3-cwt. lots, 1s 8½d per lb. ; 5-cwt. lots, 1s 8d per lb. ; 1-ton lots, 1s 7⅞d per lb. ; 5-ton lots, 1s 7½d per lb. ; Tech., 5-cwt. packed in 1-cwt. drums, £8 14s 6d per cwt. ; packed in 1 drum, £8 9s. 6d per cwt.

Salammoniac.—Per ton lot, in non-returnable packaging, £45 10s.

Salicylic Acid. — MANCHESTER : Technical 2s 8½d per lb. d/d.

Soda Ash.—58% ex-depot or d/d, London station, about £15 5s 6d per ton, 1-ton lots.

Soda, Caustic.—Solid 76/77% ; spot, £30 to £32 per ton d/d (4 ton lots).

Sodium Acetate.—Commercial crystals, £91 per ton d/d.

Sodium Bicarbonate.—Per ton lot, in non-returnable packaging, £15 10s.

Sodium Bisulphite. — Powder, 60/62%, £42 15s d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—Per ton lot, in non-returnable packaging, paid address, £59 5s.

Sodium Chlorate.—About £80 per ton in 1-cwt. drums, carriage paid station, in 4-ton lots.

Sodium Cyanide.—96/98%, £113 5s per ton lot in 1-cwt. drums.

Sodium Dichromate.—Crystals, cake and powder, 10¾d per lb. Net d/d UK, anhydrous, 1s 0½d per lb. Net del. d/d UK, 5-cwt. to 1-ton lots.

Sodium Fluoride.—Delivered, 1-ton lots and over, £5 per cwt. ; 1-cwt. lots, £5 10s per cwt.

Sodium Hyposulphite.—Pea crystals £35 15s a ton ; commercial, 1-ton lots, £32 10s per ton, carriage paid.

Sodium Iodide.—BP, 17s 1d per lb. in 28-lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £133 per ton.

Sodium Metasilicate.—£25 per ton, d/d UK in ton lots, loaned bags.

Sodium Nitrate.—Chilean refined granulated over 98% 6-ton lots, d/d station, £28 10s.

Sodium Nitrite.—£32 per ton (4-ton lots).

Sodium Percarbonate.—12½% available oxygen, £8 6s 9d per cwt. in 1-cwt. kegs.

Sodium Phosphate.—Per ton d/d for ton lots : di-sodium, crystalline, £38 10s, anhydrous, £84 ; tri-sodium, crystalline, £39 10s, anhydrous, £82.

Sodium Silicate.—75-84° Tw. Lancashire and Cheshire, 4-ton lots, d/d station in loaned drums, £10 15s per ton ; Dorset, Somerset and Devon, £3 17s 6d per ton extra ; Scotland and S. Wales, £3 per ton extra. Elsewhere in England, excluding Cornwall, and Wales, £1 12s 6d per ton extra.

Sodium Sulphate (Desiccated Glauber's Salts).—d/d in bags ton, £18.

Sodium Sulphate (Glauber's Salt).—£9 5s to £10 5s per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER : £7 per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot, £33 2s 6d per ton, d/d, in drums in 1-ton lots ; broken, £34 2s 6d per ton, d/d, in drums in 1-ton lots.

Sodium Sulphite.—Anhydrous, £66 5s per ton ; commercial, £25 5s to £27 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £20 to £22, according to fineness.

Sulphuric Acid.—Net, naked at works, 168° Tw. according to quality, per ton, £10 7s 6d to £12 ; 140° Tw., arsenic free, per ton, £8 12s 6d ; 140° Tw., arsenious, per ton, £8 4s 6d.

Tartaric Acid.—Per cwt. : 10 cwt. or more £13 10s, one cwt. £13 15s.

Titanium Oxide.—Standard grade comm., with rutile structure, £172 per ton ; standard grade comm., £152 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d, white seal, £115 ; green seal, £113 ; red seal, 2-ton lots, £110 per ton. White factice 1s 7¾d to 1s 11½d per lb.

Solvents & Plasticizers

Acetone.—Small lots : In 5-gal. cans : 5-gal., £125, 10-gal. and upward, £115, cans included. In 40/45 gal. returnable drums, spot : Less than 1 ton, £90 ; 1 to less than 5 tons, £87 ; 5 to less than 10 tons, £86 ; 10 tons and upward, £85. In tank wagons, spot : 1 to less than 5 tons (min. 400 gal.), £85 ; 5 to less than 10 tons (1,500 gal.), £84 ; 10 tons and upward (2,500 gal.), £83 ; contract rebate, £2. All per ton d/d.

Butyl Acetate BSS.—£159 per ton, in 10-ton lots.

***n*-Butyl alcohol, BSS.**—10 tons, in drums, £143 per ton d/d.

***sec*-Butyl Alcohol.**—5 gal. drums £159 ; 40 gal. drums : less than 1 ton £124 per ton ; 1 to 10 tons £123 per ton ; 10 tons and over £119 per ton ; 100 tons and over £120 per ton.

***tert*-Butyl Alcohol.**—5-gal. drums £195 10s per ton ; 40/45 gal. drums : less than 1 ton £175 10s per ton ; 1 to 5 tons £174 10s per ton ; 5 to 10 tons, £173 10s ; 10 tons and over £172 10s.

Diacetone Alcohol.—Small lots : 5 gal. drums, £177 per ton ; 10 gal. drums, £167 per ton. In 40/45 gal. drums ; less than 1 ton, £142 per ton ; 1 to 9 tons, £141 per ton ; 10 to 50 tons, £140 per ton ; 50 to 100 tons, £139 per ton ; 100 tons and over, £138 per ton.

Dibutyl Phthalate.—In drums, 10 tons, 2s per lb. d/d ; 45-gal. drums, 2s 1½d per lb. d/d.

Diethyl Phthalate.—In drums, 10 tons, 1s 11½d per lb. d/d ; 45 gal. drums, 2s 1d per lb. d/d.

Dimethyl Phthalate.—In drums, 10 tons, 1s 9d per lb. d/d ; 45 gal. drums, 1s 10½d per lb. d/d.

Dioctyl Phthalate.—In drums, 10 tons, 2s 8d per lb. d/d ; 45 gal. drums, 2s 9½d per lb. d/d.

Ether BSS.—In 1 ton lots, 1s 11d per lb. ; drums extra.

Ethyl Acetate.—10 tons lots, d/d, £128 per ton.

Ethyl Alcohol (PBS 66 o.p.).—Over 300,000 p. gal., 2s 9d ; 2,500-10,000 p. gal., 2s 11½d per p. gal., d/d in tankers. D/D in 40/45-gal. drums, 1d p.p.g. extra. Absolute alcohol (75.2 o.p.) 5d p.p.g. extra.

Methanol.—Pure synthetic, d/d, £43 15s per ton.

Methylated Spirit.—Industrial 66° o.p. : 500 gal. and over in tankers, 4s 10d per gal. d/d ; 100-499 gal. in drums, 5s 2½d per gal. d/d. Pyridinised 64 o.p. : 500 gal. and over in tankers, 5s 0d per gal. d/d ; 100-499 gal. in drums, 5s 4½d per gal. d/d.

Methyl Ethyl Ketone.—10-ton lots, £133 per ton d/d ; 100-ton lots, £131 per ton d/d.

Methyl *iso*Butyl Ketone.—10 tons and over £159 per ton.

***iso*Propyl Acetate.**—In drums, 10 tons, £123 per ton d/d ; 45 gal. drums, £129 per ton d/d.

***iso*Propyl Alcohol.**—Small lots: 5-gal. drums, £118 per ton ; 10-gal. drums, £108 per ton ; in 40-45 gal. drums ; less than 1 ton, £83 per ton ; 1 to 9 tons £81 per ton ; 10 to 50 tons, £80 10s per ton ; 50 tons and over, £80 per ton.

Rubber Chemicals

Carbon Disulphide.—£61 to £67 per ton, according to quality.

Carbon Black.—8d to 1s per lb., according to packing.

Carbon Tetrachloride.—Ton lots, £79 10s per ton.

India-Rubber Substitutes.—White, 1s 5¾d to 1s 9½d per lb. ; dark, 1s 4d to 1s 6¾d per lb. delivered free to customers' works.

Lithopone.—30%, about £55 per ton.

Mineral Black.—£7 10s to £10 per ton.

Sulphur Chloride.—British, about £50 per ton.

Vegetable Lamp Black.—£64 8s per ton in 2-ton lots.

Vermilion.—Pale or deep, 15s 6d per lb. for 7-lb. lots.

Coal-Tar Products

Benzole.—Per gal., minimum of 200 gals. delivered in bulk, 90's, 5s ; pure, 5s 4d.

Carbolic Acid.—Crystals, minimum price 1s 4d to 1s 7d per lb. delivered in bulk, ½d per lb. extra in 40/50 gal. returnable drums. Crude, 60's, 8s per gal. Manchester : Crystals, 1s 4d to 1s 7d per lb., d/d crude, 8s naked, at works.

Creosote.— Home trade, 1s to 1s 9d per gal. according to quality, f.o.r. maker's works. MANCHESTER : 1s to 1s 8d per gal.

Cresylic Acid.—Pale 99/100%, 6s 4d per gal. ; 99.5/100%, 6s 6d per gal. D/d UK in bulk : Pale A.D.F. from 7s 3d per imperial gallon f.o.b. UK, 95 cents per US gallon, c.i.f. NY.

Naphtha.—Solvent, 90/160°, 5s per gal ; heavy, 90/190°, 3s 11d per gal. for bulk 1000-gal. lots, d/d. Drums extra ; higher prices for smaller lots.

Naphthalene.—Crude, 4-ton lots, in buyers' bags, £18 1s 6d to £29 12s per ton nominal, according to m.p. ; hot pressed, £41 10s 6d per ton in bulk ex-works ; refined crystals, £60 10s per ton d/d min. 4-ton lots.

Pitch.—Medium, soft, home trade, £9 per ton f.o.r. suppliers' works ; export trade about £10 10s per ton f.o.b. suppliers' port.

Pyridine.—90/160, 20/- to £1 2s 6d per gal.

Toluole.—Pure, 5s 9d ; 90's 5s 0d per gal. d/d. 1000 gal. lots in bulk. MANCHESTER : Pure, 5s 9d per gal. naked.

Xylole.—5s 10d to 6s 3½d per gal., according to grade, in 1000 gal. lots d/d London area in bulk.

Intermediates & Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—4s 9d per lb. d/d.

***o*-Cresol** 30/31° C.—1s per lb. d/d.

***p*-Cresol** 34/35° C.—4s 9d per lb. d/d.

Dichloraniline.—4s 3½d per lb.

Dinitrobenzene.—88/99° C., 2s per lb.

Dinitrotoluene.— S.P. 15° C., 2s 0½d per lb. ; S.P. 26° C., 1s 4d per lb. ; S.P. 33° C., 1s 2d per lb. ; S.P. 66/68° C., 1s 10d per lb. Drums extra.

***p*-Nitraniline.**—4s 10d per lb.

Nitrobenzene.—Spot, 10d per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—2s 4d per lb.

***o*-Toluidine.**—1s 10d per lb., in 8/10-cwt. drums, drums extra.

***p*-Toluidine.**—5s 9½d per lb., in casks.

Dimethylaniline.—3s 3d per lb., drums extra, carriage paid.

Chemical & Allied Stocks & Shares

THE set-back on Wall Street and other factors have made for renewed caution in stock markets. Share values reflected profit-taking after earlier gains, though generally the volume of business remained at a good level in most sections. It is clear, however, that despite the good financial results which most companies have been able to report for the past year, the problem of rising costs, increased competition and lower profit margins is continuing to present industry with many problems.

Will Upward Trend Continue?

In the circumstances, the main talking point in the City is whether the upward trend in dividends can be continued. The prevailing view is that although there will probably be a good number of dividend increases in prospect, they will be considerably less than those announced for the past year. In fact, it is being assumed that, judged on yield considerations, many shares are probably now fully valued from the near-term outlook. On the other hand, it is realized that partly owing to the big holdings by investment, insurance companies and pension funds, many shares are in short supply in the market, so moderate demand could at any time cause prices to rise sharply.

Shares of chemical and kindred companies have naturally moved closely with the general trend on the Stock Exchange, and were lower on balance. Imperial Chemical at 47s xd. compared with 49s 6d a month ago. The annual review of the group has emphasized its widespread activities and the great attention given to efficient working and research. The review refers to lower profit margins and the policy of absorbing increased costs where this can be justified. This probably explains why it was decided to keep the dividend unchanged at 10 per cent. It is expected that at the annual meeting on 14 June Sir Alexander Fleck will refer to these factors and the company's dividend policy.

Elsewhere, William Blythe 3s shares have changed hands around 11s 3d. Monsanto 5s shares receded on the month from 30s to 27s, but Fisons at 55s 9d moved slightly higher on balance. Hickson & Welch 10s shares have moved up from 29s to 31s 6d, and Hardman & Holden 5s shares at 11s were within 3d of the level a month ago. Albright & Wilson 5s shares have come back from 21s 1½d to 18s 10½d.

Yorkshire Dyeware & Chemical 5s shares remained at 10s, and despite sharp fluctuations Reichhold Chemical at 18s 3d have been maintained on balance and yield over 6 per cent on the basis of last year's 22½ per cent dividend. Anchor Chemical 5s shares at 13s were also the same as a month ago. Willows Francis 2s 6d shares were well maintained at 4s 4½d, while Laporte 5s shares strengthened to 19s 1½d. Lawes Chemical 5s shares remained at 15s 7d. Brotherton 10s shares have strengthened to 35s 6d and British Chrome Chemicals 5s shares from 11s 9d to 12s. F. W. Berk 5s shares have been well maintained at 8s, while British Glues & Chemicals 4s shares strengthened from 10s 9d to 11s 3d. Coalite & Chemicals 2s shares were higher at 4s but, compared with a month ago, British Industrial Plastics 2s shares came back from 6s to 5s 7½d. British Xylonite were 33s 9d, compared with 36s, and Bakelite 10s shares 30s, compared with 28s 3d. The 6s 8d units of the Distillers Co. have come back to 22s 6d, as against 24s 9d a month ago. Unilever moved up from 78s 9d to 80s and United Molasses from 42s to 42s 6d. Triplex Glass 10s shares receded from 40s 3d to 39s 7½d with the prevailing trend. Elsewhere, Boots Drug 5s units were 16s against 18s a month ago, despite the good financial results.

Courtaulds' Partial Rally

Among other shares, Courtaulds at 39s made a partial rally; general expectations are that the dividend will be maintained at 10 per cent. Iron and steel shares lost some ground on the view that because of the large sums which will be required to increase plant so as to expand production, the scope for higher dividends is probably only moderate over the next year or so.

Australia to Buy Heavy Water

Australia will buy about 10 tons of heavy water from the United States for a proposed new atomic reactor to be built near Sydney, Mr. Howard Bale, Minister of Supply, told Parliament on 17 May.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Satisfaction

EVERSHED & VIGNOLES LTD., London W, electrical engineers.—Satisfaction 26 April, that property (Minerva Road Works, 52 Minerva Road, Acton) comprised in a Trust Deed registered 28 March, 1956, has been released from the charge.

Increases of Capital

WALTERISATION CO. LTD., Waddon Marsh Way, Purley Way Croydon, Surrey, increased by £40,000, in £1 ordinary shares, beyond the registered capital of £10,000.

B. W. E. BEARD LTD., 33/4 Chancery Lane, London WC2, increased by £2,000, in £1 shares beyond the registered capital of £10,000.

Changes of Name

DEODOR-X HYGIENE SERVICES LTD., 309 Corporation Road, Birkenhead, to Scientex Ltd., on 27 March, 1956.

DEODOR-X HYGIENE SERVICES (SOUTHERN) LTD., 309 Corporation Road, Birkenhead, to Scientex (Southern) Ltd., on 27 March 1956.

DEODOR-X HYGIENE SERVICES (TYNESIDE) LTD. (524,441). 309 Corporation Road, Birkenhead, to Scientex (Tyneside) Ltd., on 27 March, 1956.

Receivership

NEWBALL & MASON LTD., manufacturing chemists, etc., Beech Avenue, Nottingham. Peter R. Coope of 9 Clarendon Street, Nottingham was appointed Receiver on 2 May, 1956, under powers contained in series of debentures issued 21 January, 1956.

Company News

Dunlop Rubber Co. Ltd.

Dunlop sales to the public last year reached a record £219,000,000, a rise of 15 per cent over 1954, and the estimated increase in the volume of goods sold was six per cent. Aggregate sales, including supplies within the group, rose from £262,000,000 to £302,000,000. Selling prices were not sufficiently increased to offset the increase in raw material and other costs, and the margin of profit, as a percentage of sales, fell from 6.2 per cent. in 1954 to 5.3 per cent after all charges except tax. The 57th annual general meeting of the company will be held at the Piccadilly Hotel, London W1, on 11 June at 12 noon.

United British Oilfields of Trinidad Ltd.

After making provision for depletion, depreciation and taxation, the profit of United British Oilfields of Trinidad Ltd. for the year ended 31 December, 1955, was £1,345,815, against £983,800 in 1954. This improvement is attributed to increased crude oil production and refinery throughput. Overall production in 1955 showed an increase of some 10 per cent over 1954. Refinery throughput averaged 30,954 barrels per day during 1955. The resolution to change the name of the company to 'Shell Trinidad Ltd.' was passed at the annual meeting on 16 May.

British Petroleum Co. Ltd.

The consolidated trading profit and other income of The British Petroleum Co. Ltd. in 1955, before providing for depreciation and overseas taxation, was £139,817,943, compared with £118,228,792 for 1954. Total sales increased by 15 per cent, during the

year, crude oil production by 25 per cent, and refining throughput by 23 per cent, while exploration and marketing operations were further diversified and extended. Total capital expenditure was approximately £43,000,000. Total crude oil production in 1955 was 46,000,000 tons, over 9,000,000 tons more than in 1954, the increase being mainly due to larger production in Iran and Kuwait.

Albright & Wilson Ltd.

Albright & Wilson's trading profit for 1955 was £3,200,000 compared with £3,134,000 for 1954. Charges for depreciation increased by £135,000 from £1,264,000 to £1,399,000, reflecting the expansion of productive facilities. Group taxation rose by £32,000, an increase of £190,000 in overseas taxation being partly offset by a reduction of £158,000 in UK charges. Net profit attributable to stockholders of Albright & Wilson Ltd. was almost unchanged at £859,000 compared with £860,000 in 1954. During the year, the issued ordinary capital of the company was increased from £2,028,000 to £4,564,000. A final dividend of 13 per cent is recommended, making 18 per cent for the year.

Greeff-Chemicals (Holdings) Ltd.

The directors recommend a final dividend of 11 per cent for the year 1955 on the ordinary capital increased to £500,000 by a one-for-four rights issue in January this year. A five per cent interim was paid on a smaller capital, and in respect of 1954 a total of 17½ per cent was distributed. Group profit before tax of £69,839, rose from £134,916 to £137,736.

Next Week's Events

WEDNESDAY 30 May

SCI (Chemical Engineering Group)

London: The Cafe Royal, Regent Street W1, 6.15 p.m. Annual general meeting and dinner.

THURSDAY 31 MAY

The Fertilizer Society

Haslemere: Fernhurst Research Station, 10.30 a.m. 'Use of Fertilizers for Glasshouse Crops' by Professor Hugh Nichol, Ph.D., F.R.I.C., F.R.S.E., followed by tour of the research station.

SATURDAY 2 JUNE

The Society of Chemical Industry

Food and agriculture group's foreign tour until 9 June.

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PATENTS & TRADE MARKS

KINGS PATENT AGENCY, LTD., (B. T. King A.M.I.Mech.E., Patent Agent), 146a, Queen Victoria Street, London, E.C.4. **ADVICE** Handbook, and Consultation free. Phone: City. 6161

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